Abstract

We propose a coincidence measurement of K^+ and p from the $\vec{\gamma}p \rightarrow K^+\vec{\Lambda}^0$, $\Lambda^0 \rightarrow p\pi^-$ reaction, for photon energies from 3 to 6 GeV, and for K^+ angles in the center of mass from 50° to 130°. The polarized photons will be generated with a 25 μA beam of 80% longitudinally polarized electrons. The measurement of the recoil $\vec{\Lambda}^0$ polarization components P_l, P_t, and P_n will be the first polarization measurements in this energy regime, and will have statistical uncertainties $\leq \pm 0.1$. Six existing cross section points for $\theta^K_{cm} \geq 70°$ are known with uncertainties of about 50%; we overlap these points and extend the angle range, measuring 18 points with uncertainties of 5 - 10%.

Our aim is to understand the exclusive reaction mechanism, in particular to test the various quark-based reaction models that are now available. Recent theoretical advances indicate that, with these new experimental data, we should be able to:

- examine the role of spin in this reaction, since the spin of the Λ^0 is believed to be carried by the s quark, and the Λ^0 polarization is predicted to be large,
- extract information about competing reaction mechanisms, since mechanisms such as kaon knockout, kaon production from the quark, and "diffractive" kaon production are generally expected to have different spin structures,
- observe deviations from the Brodsky-Farrar constituent counting rules, since estimates of deviations are now available, and the estimated deviations can be seen with the uncertainties of this measurement, and
- learn about non-forward parton distributions, since within this framework of "soft" physics, the power-law behavior of the cross section data can be estimated.

1 Motivation

1.1 Introduction

Our experimental knowledge of exclusive photoreactions for energies above 3 GeV is extremely limited. Data [1, 2, 3] mostly date from the 1970s. The